DEPARTMENT OF CHEMICAL ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Course Title	PROCESS CALCULATIONS		
Course Code	CLPC 15 (B.Tech-Chemical Engg)	No. of Credits	L T P C 3 1 0 4
Course Code of Pre-requisite subject(s)	NIL		
Session	July. 2018	Section (if, applicable)	
Name of Faculty	Dr. N. Anantharaman	Department	Chemical Engg R.No.: 102
Email	naraman@nitt.edu	Telephone No.	0431-2503103
Name of Course Coordinator(s) (if, applicable)	Dr. P. Sivashanmugam		
E-mail	psiva@nitt.edu	Telephone No.	2503106
Course Type	[x] Core course	[ ] Elective course	

Syllabus (approved in BoS)

Stoichiometry: Introduction - Units and Dimensions - Stoichiometric principles –composition relations, density and specific gravity.

Ideal Gases and Vapor Pressure: Behaviour of Ideal gases - kinetic theory of gases - application of ideal gas law - gaseous mixtures - volume changes with change in composition. Vapour pressure - effect of Temperature on vapour pressure - vapour pressure plots - vapour pressure of immiscible liquids - solutions.

Humidity and Solubility: Humidity - saturation - vaporization - condensation - wet and dry bulb thermometry Solubility and Crystallisation - Dissolution - solubility of gases.

Material Balance: Material Balance - Processes involving chemical reaction - Combustion of coal, fuel gases and sulphur - Recycling operations - bypassing streams - Degree of conversion – excess reactant - limiting reactant. Unsteady state problems

Energy Balance: Thermo chemistry - Hess's law of summation - heat of formation, reaction, combustion and mixing - mean specific heat - Theoretical flame Temperature

TEXT BOOKS:

1. *Himmelblau, "Basic Principles and Calculations in Chemical Engineering", 8th Edn., Prentice Hall of India Ltd, India 2012*
2. *V.Venkataramani, N.Anantharaman and K.M. Meera Sheriffa Begum, 2nd Edn., 'Process Calculations' Prentice Hall of India Ltd, New Delhi. 2013*

REFERENCE BOOKS:

3. *O. A .Hougen, K. M. Watson and R. A. Ragatz, "Chemical Process Principles", Vol- I, CBS Publishers and Distributors, New Delhi, 1995.*
4. *B. I. Bhatt, "Stoichiometry", 5th Edn., Tata McGraw Hill Publishers Ltd., New Delhi, 2010.*

COURSE OBJECTIVES

1. **To give students fundamental knowledge in Units and conversions and also the basic laws governing chemical operations.**
2. **To impart knowledgeable on material and energy balance with and without reactions**

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)
At the end of the course, student will have	
the capability to convert units and dimensions and also modify equations from one system to another	**PO1, PO2, PO3, PO5, PO8. PO9 , PO11, and PO12**
the capability apply the laws of physics and chemistry in solving process industry related applications.	**PO1, PO2, PO4, PO5, PO8, PO9, PO11and PO12**
the proficiency to integrate the data and formulate the mass and energy balance problems	**PO1,PO2,PO3,PO5,PO8, PO9, PO11 and PO12**
the capability to use mathematical knowledge for solving mass and energy balance problems with and without chemical reactions	**PO1,PO2, PO3, PO5, PO8, PO9, PO11 and PO12**

COURSE PLAN – PART II

COURSE OVERVIEW

1. **To give students fundamental knowledge in Units and conversions and also the basic laws governing chemical operations.**
2. **To impart knowledgeable on material and energy balance with and without reactions**

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/contact hours	Topic	Mode of Delivery
1	Week 1	Introduction and Objectives	Chalk and talk
2	Week 1	Introduction to units and Dimensions	Chalk and talk
3	Week 1	Problems on conversion of units	Chalk and talk
4	Week 1	Conversion of equations	Chalk and talk
5	Week 2	Problems on conversion of equations	Chalk and talk
6	Week 2	Expressing concentration and density	Chalk and talk
7	Week 2	Expressing concentration and density (continued)	Chalk and talk
8	Week 2	Problem solving	Chalk and talk
9	Week 3	Concept of average molecular weight	Chalk and talk
10	Week 3	Problems	Chalk and talk

11	Week 3	Ideal gases	Chalk and talk
12	Week3	Concepts of partial pressure and partial volume	Chalk and talk
13	Week 4	Problems on non-reacting systems	Chalk and talk
14	Week 4	Problems on reacting systems	Chalk and talk
15	Week 4	Concept of vapour pressure	Chalk and talk
16	Week 4	VLE data estimation	Chalk and talk
17	Week 5	Application to mass balance	Chalk and talk
18	Week 5	Steam distillation	Chalk and talk
19	Week 5	Concepts of crystallization	Chalk and talk
20	Week 5	Problems on estimation of yield	Chalk and talk
21	Week6	Problems on estimation of yield with hydrated salt	Chalk and talk
22	Week 6	Definitions on psychrometry terms	Chalk and talk
23	Week 6	Test 1	
24	Week 6	Psychrometric chart and its uses	Chalk and talk
25	Week 7	Problem solving using psychrometric chart	Chalk and talk
26	Week 7	Problem solving using psychrometric chart	Chalk and talk
27	Week 7	Problem solving using psychrometric chart	Chalk and talk
28	Week 7	Material balance for non reacting systems	Chalk and talk
29	Week 8	Material balance for non reacting systems	Chalk and talk
30	Week 8	Material balance for reacting systems	Chalk and talk
31	Week 8	Material balance for reacting systems	Chalk and talk
32	Week 8	Material balance for reacting systems	Chalk and talk
33	Week 9	Material balance for reacting systems	Chalk and talk
34	Week 9	Combustion problems	Chalk and talk
35	Week 9	Combustion problems	Chalk and talk
36	Week 9	Combustion problems	Chalk and talk
37	Week 10	Recycle, purge and bypass	Chalk and talk
38	Week 10	Recycle, purge and bypass	Chalk and talk
39	Week 10	Test 2	
40	Week 10	Thermo-chemistry concepts	Chalk and talk
41	Week 11	Problems on the above topic	Chalk and talk
42	Week 11	Energy balance	Chalk and talk
43	Week 11	Adiabatic flame temperature estimation	Chalk and talk
44	Week 11	Adiabatic flame temperature estimation	Chalk and talk
45	Week 12	Material balance in Unsteady state operations	Chalk and talk
46	Week 12	Material balance in Unsteady state operations	Chalk and talk
47	Week 12	Energy balance in Unsteady state operations	Chalk and talk
48	Week 12	Overview of the course	Talk

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment -1(assignment)	4th week	-	3%
2	Assessment -2 (test)	6th week since commencement	1 hour	20%

3	Assessment -3(assignment)	9th week	-	4%
4	Assessment -4(test)	12th week since commencement	1 hour	20%
5	Assessment -5(assignment)	14th week	-	3%
6	End semester examination	16th week since commencement	1 hour	50%
CPA	Compensation ASSESSMENT*	14th week		20%

***mandatory; refer to guidelines on page 4 (Will cover both 2 and 4 assessments)**

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

1) Feedback is planned to be collected twice; once in the mid semester and one at the end of course as soon as classes are over.
2) The academic performance of the students will be assessed based on 2 cycle tests (each 20 marks), one final examination (50 marks) and assignments (10 marks).
3) Suitable mapping of COs with POs will be made and attainment will be calculated.

COURSE POLICY (preferred mode of correspondence with students, policy on attendance, compensation assessment, , academic honesty and plagiarism etc.)

MODE OF CORRESPONDENCE (email/ phone etc) :

Through Phone/email with Class representative

ATTENDANCE :

1) Attendance of 75% and above is expected. The 25% allowance is given for absence due to illness/institute related activities(sports/competitions/seminars etc)

COMPENSATION ASSESSMENT :

Will cover both I and II assessments (written test) for those who have missed either I or II or both, on genuine grounds

ACADEMIC HONESTY & PLAGIARISM

1) It is expected that the students will not indulge in any form of malpractice. In the event of any malpractice reported, all those who are involved will forfeit all the marks in that test/examination/assignment. Reappearance /additional assignment will not be given.

ADDITIONAL INFORMATION

The Course Coordinator is available for consultation at times that are displayed on the coordinator's office notice board. Queries may also be emailed to the Course Coordinator directly at **naraman@nitt.edu**

FOR APPROVAL

Course Faculty N.Ananta **CC-Chairperson** S. Saravanan **HOD**

a) The number of assessments for a course shall range from 4 to 6.

b) **Every course shall have a final assessment on the entire syllabus with at least 30% weightage.**

c) **One compensation assessment for absentees in assessments (other than final assessment) is mandatory. This is not applicable for project work/industrial lectures/internship**.

d) The policy for attendance for the course should be clearly specified.

e) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.